REMARKS

Claim 1 - 15 remain in the application. Claim 14 has been amended to proper dependent format. This amendment overcomes the objection raised in the office action.

In the United States, the first commercial fiber optic video transmissions were in the early 1980s. These transmissions were the television broadcast of the Democratic National Convention and the Winter Olympics at Lake Placid. The fiber optic cables of that time were large core, multi-fiber bundles using AM modulation. These first transmissions used rack mounted optical transmitter and receivers in fixed facilities due to the difficulty in maintaining a good fiber optic connection. Unlike electronic connections, optics requires precise in-line alignment to couple signals between systems. Over the years, the technology has evolved from AM to FM and then finally to digital modulation. Optically, we have advanced from low power LED sources to efficient laser diodes. As a result of these and other changes, the higher capacity single mode fiber predominates. With the reduction in size and the increase in bandwidth, the opportunities for fiber optic applications have exploded. Hence, the technology of the fiber optic connectors has had to keep pace. No longer are transmission stations large, fixed buildings. Instead, fiber optic transmission is used throughout the world, frequently in remote, mobile locations.

From the very beginning, the fiber optic connector has been a limiting component in designing a field fiber optic system. For example, within a military environment, fiber optic connectors were intended to be deployed quickly under rigorous conditions by semi-skilled troops, and survive in virtually all environments. The first fiber optic connector systems used threaded optical connectors similar in design to the coaxial connectors of the copper wire technology. Due to the poor alignment with in these connectors the effective distance of a fiber optic link was severely limited by accumulated connector losses. The threaded, keyed connectors have been replaced throughout the

industry with bayonet style connectors. These new connectors attempt to address the problems associated with the attenuation across the connection. However, improvements in connector attenuation as well as the requirements for the durability and ease of use are continue to driving the innovations in connector design today.

The fiber optic module or connector of the current design addresses the attenuation by making a direct connection between the hermetically sealed laser diode cap assembly and the optical fiber assembly. The current application allows for alignment testing to ensure it is connected at the optimal optical position thus minimizing any attenuation of the coupling. Then, the two assemblies are fixed together to maintain alignment while the resin housing is completed. The current application further addresses the durability and rugged performance requirements by creating a one-piece molded product using injected resin to protect the assemblies from the environment and ensuring alignment is maintained. The four prior art references identified by the Examiner do not provide these features in one, integrated, reliable product.

Claims 1, 3, 4, 6, 7, 9 and 10 have been rejected under 35 U.S.C. 102 (b) as having been anticipated by Cook (3,950,075). This rejection is traversed.

not claimed

In brief, the Cook (3,950,075) invention provided cap assembly is not larger in diameter than the fiber optic assembly nor does it permanently connect the semiconductor assembly with the fiber optic assembly. The Cook (3,950,075) invention outer dimension of the open end face of the housing cannot be equal or smaller than the outer dimension of the upper surface of the cap as claimed in the present application. In addition, Cook suggests using a threaded connection assembly similar to the coaxial cable connection systems that have been shown to be unreliable for maintaining optical alignment as mentioned above. The Examiner has interpreted the element 26 of Cook (3,950,075) to be a cap, however, the optical semiconductor element of the current invention should correspond to the diode 12 and transparent protective layer 30 of Cook (3,950,075).

This is not the case as the detailed structure of the semiconductor device in Cook (3,950,075) is not disclosed.

In addition to the differences in form and function noted above, the following specific differences between the invention and the Cook reference should be noted.

Cook has stem portion equal to or larger than cap.

Current application has stem portion smaller or equal to cap (Claim 2 and Claim 3).

Cook does not seal the cap assembly just put epoxy across the window.

Current application specifically has a hermetically sealed cap assembly.

Cook states a window could be used between diode and fiber optic bundle (column 3, lines 58 - 59). A window may be provided via the clear epoxy and the cap is not sealed.

Current application specifically requires window.

Cook seals the exterior case of the final product with some type of screw and nut device and threaded assemblies (Figure 1).

Current invention uses encapsulating resin injected into the housing to make one integrated product (Claim 7).

Claims 1, 3, 4, 6, 7, 9, 10, 11, and 14 have been rejected under 35 U.S.C. 102 (b) as being anticipated by Takahashi (5,631,992).

couldn't ever really be?
RDG

Although the structure is similar, the Takahashi (5,631,992) invention housing in not directly connected to the cap (Claim 1). That is, the end of the housing of the current application is connected (or bonded) to the cap directly (with an adhesive), whereas, the Takahashi (5,631,992) invention teaches the end end of the second holder 10 is connected to the cap 3 through the seal ring 19 made of synthetic rubber. The seal ring is provided for hermetically charging the refractive index matching agent 18, which is gelled material, within the ring 19. Thus, the Takahashi (5,631,992) invention fails to teach the housing is bonded to

the cap directly. In addition, the outer diameter of the second holder 10 of the Takahashi (5,631,992) invention becomes larger than that of the cap 3 on the left side of Fig. 1. Although it is recited only at the end of the housing, the outer diameter of the housing is equal to or smaller than the diameter of the cap as claimed in the current invention allowing down-sizing of the device. Thus, the structure taught by the Takahashi (5,631,992) invention is also distinguished from the claimed invention in terms of down-sizing the device.

In addition to the differences in form and function noted above, the following specific differences between the invention and the Takahashi reference should be noted.

Takahashi teaches that a seal ring is inserted between the light source element and the fiber optic assembly.

Current application has the light source cap assembly in direct contact with the fiber optic assembly (Claim 1).

Takahashi seal ring and matching agent (adhesive gel) are inserted and the second holder is coupled to the first holder, then the axis a aligned.

Current application has the light source cap in contact with the fiber optic assembly. The two assemblies are aligned, then the adhesive is activated via ultraviolet light curing.

Takahashi spot welds the exterior assembly housing after aligning internal assemblies (Column 3, line 20).

Current application injects resin to completely seal and integrate into one cohesive assembly.

Claims 1, 3, 4, 6 - 9, and 11 are rejected under 35 U.S.C. 102 (b) as having been anticipated by Meadowcroft (5,522,001).

The Meadowcroft (5,522,001) invention is different from the current application in several ways. First, the Meadowcroft assembly intentionally places an intermediary component 12 in between the semiconductor assembly 10 and the

fiber optic assembly 11. Further, the semiconductor device within the cap assembly is not fixed and the assembly is not sealed. Thus, direct connection or bonding of the upper surface of a sealing cap and an opened end of a housing is precluded and, importantly the lateral dimensions of the module are *necessarily* increased while it appears that accurate alignment would be compromised. It is also noted and believed to be significant in Meadowcroft that the bond may be dimensionally unstable (column 4, lines 44 - 53) and clearances (see, for example, column 4, lines 33 - 43) which may complicate the alignment are required for the application of adhesive which is pulled into the clearance by capillary or "wicking" action (see column 5, lines 19 - 26). Therefore, only rough alignment is possible and even that rough alignment cannot be closely maintained due to dimensional instability of the adhesive and then only at the expense of increasing overall and lateral dimensions of the module. The intermediate part 12, 46 cannot be omitted consistent with the teachings of Meadowcroft and necessarily increases the lateral dimensions of the module beyond the dimensions of the cap. In Irie et al. the bonding surface is conical and does not allow for alignment while the bonding is essentially lateral and requires space in the lateral direction or dimension of the optical module. The laterally located mechanical connection of Kim et al. similarly does not permit alignment and requires lateral space and increase of lateral dimensions as may be best observed from Figure 3 thereof.

In addition to the differences in form and function noted above, the following specific differences between the invention and the Meadowcroft reference should be noted.

- Meadowcroft requires an intermediary component in between light source assembly and fiber optic assembly.

Current application requires direct contact between the two assemblies.

In Meadowcroft, the light source assembly is not hermetically sealed and is secured within the intermediary components assembly. The current application has a hermetically sealed light source cap assemble that is in direct contact with

the fiber optic assembly (Claim 1).

Meadowcroft has the fiber optic assembly inserted in the housing and aligned. An adhesive is then applied to fix the two assemblies together. Meadowcroft acknowledges that some movement of the assemblies relative to each other may take place (column 4, lines 49 - 52 and column 6, line 16).

Claims 5 and 12 have been rejected under 35 U.S.C. 103 (a) as being unpatentable over Takahashi.

As mentioned above, the Takahashi method for building the optical module has the seal ring and refractive index gel inserted prior to alignment (column 3, lines 13 - 15). Takahashi specifically calls for a refractive index matching agent 18 which is a silicon-based gelled material to be inserted between the light source cap assembly and the fiber optic assembly. The current application has an adhesive between the light source cap assembly and the fiber optic assembly that is irradiated by ultraviolet light in order to cure and maintain the correct alignment until the resin around the two assemblies can be injected. There is no information to determine if silicon-based gelled material can withstand ultraviolet light irradiation without corrupting the refractive index. Suggesting that irradiating the refractive gel would be obvious ignores the possibility that this irradiation may change the refractive index associated with the material and would interfere with the inventors intended function. Further, the refractive index matching agent and the seal ring of Takahashi suggest that there is some substance in between the two target assemblies. In contrast to the direct connection required for the current application.

Claims 13 and 15 have been rejected under 35 U.S.C. 103 (a) as being unpatentable over Takahashi in view of Benzoni (5,337,398.

In the fourth referenced prior art, Benzoni et al. (5,337,398) provides a multiple connector device for coupling fiber optic cables within a rack mounting environment. The design, as taught by Benzoni uses a silicon substrate (circuit

board) to mount the semiconductor assemblies. These semiconductor devices are not located in a sealed cap, therefore, they are not hermetically isolated from the fiber optic assemblies. With the deficiencies in the Takahashi invention noted above and the Benzoni et al. (5,337,398) differences, these inventions cannot be joined in any combination to produce the current application.

In addition to the differences in form and function noted above, the following represents a number of specific differences between the invention and the Benzoni reference.

Benzoni suggests a plurality of optical modules, however, Benzoni does not provide a hermetically sealed cap for the light source assemblies.

Current application maintains the integrity of the multiple light source assemblies by providing the hermetically sealed cap for each module (Claim 13).

Benzoni connects the final assembly via ultrasonic welds, snap fits, bayonet catches or other similar connections. Encapsulating of the plural module is provided without ensuring separation of the individual assemblies within the plural module.

Current application specifically maintains the separation of each light source assemble and its direct connection to the associated fiber optic assembly even as the plurality of modules are sealed within a single resin encapsulation (Claim 13 and Claim 15).

Alignment within the Benzoni invention is done by aligning the lens directly onto the circuit board.

Current application has each light source assembly being aligned and connected to individual fiber optic assemblies. The multiple assemblies are then encapsulated as one unit.

In view of the foregoing, it is respectfully requested that the application be reconsidered, that claims 1 - 15 be allowed, and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,

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